TEAM POWER

Rec'D 3HW34
JUN 7 1985

6 June 1985

Mr. Gross,

Here is a copy of what was sent in April.

Since the July 5 date is rapidly approaching, I would like a determination on us being able to continue to operate until a determination is made on our variance request.

E. W. Griffiths

E. W. Griffiths
Ed

EWG/jar

Dave Sussman

SCOTFOAM
A SUBSIDIARY OF GF

bcc: P. Haslanger
D. Knoll

30 April 1985

Mr. James Seif, Regional Administrator
Environmental Protection Agency
6th & Walnut Sts.
Philadelphia, PA 19106

RE: 40 CFR Part 260.32

Mr. Seif:

SCOTFOAM Corporation presently operates a Kelley Two Stage Pyrolytic Incinerator coupled to a York Shipley Heat Recovery Boiler. (descriptive literature enclosed). The unit is also equipped to burn liquid waste.

The unique aspect of the Kelley Unit is the second stage, which the Kelley Company calls a "Thermal Reactor". By operating the primary chamber in a non-stoichiometric condition, combustible waste is converted to combustible gases. This results in a more efficient conversion to carbon dioxide and water in the thermal reactor. Thus, significant energy is being recovered in the second chamber. This type incineration unit is not specifically covered in the regulations.

We presently incinerate several classes of liquids for energy recovery. With the definition of hazardous waste, boilers, and incinerators in the final rule of 4 January 1985, we will no longer be permitted to do this.

SCOTFOAM Corporation is therefore, requesting a variance under 40 CFR 260.32 to have our unit classified as a boiler. Specifically, our unit:

a. is connected directly to the plant steam system. Therefore, 100% of the generated steam is transported to the plant.

    1) During warm weather, this unit generates sufficient steam to meet the requirements of the plant.
    2) During cold weather, it functions as the lead boiler.

Mr. James Seif, Regional Administrator

RE: 40 CFR Part 260.32

b. The basic design of this type unit builds in a reduced thermal efficiency (as compared to a standard boiler.) During 1984, our estimate of the overall thermal conversion was 63%.

c. Our unit, i.e. Incinerator and Heat Recovery Boiler, while not being an integral unit, were purchased as a Heat Recovery System and not as a hazardous waste disposal unit as the regulation suggests (CFR, Vol. 25, No. 3/4 Jan., 1985 P. 625).

Specific operating information is:

1. Main chamber temperature 1250-1400^{o}F.
2. Thermal Reactor Temperature 1400-2000^{o}F
   a. Average 1750-1800^{o}F
3. Residence Time - 0.44 sec.

Specific Hazardous Waste or Liquids Incinerated

1. Flammable Liquids - (Examples) methanol, xylene, and N-ethyl morpholine.
2. Still Bottoms - mixture of polypropylene oxide polyol, surfactants, mineral oil plus low levels of methylene chloride; original waste stream is generated from machine flush; methylene chloride is recovered from still and residue is burned.

3. Toluene Di-isocyanate - generated during pump calibration.

Should additional information relating to our operation be required, please feel free to contact me.

Very truly yours,

E.W. Griffiths

E. W. Griffiths
Environmental Manager

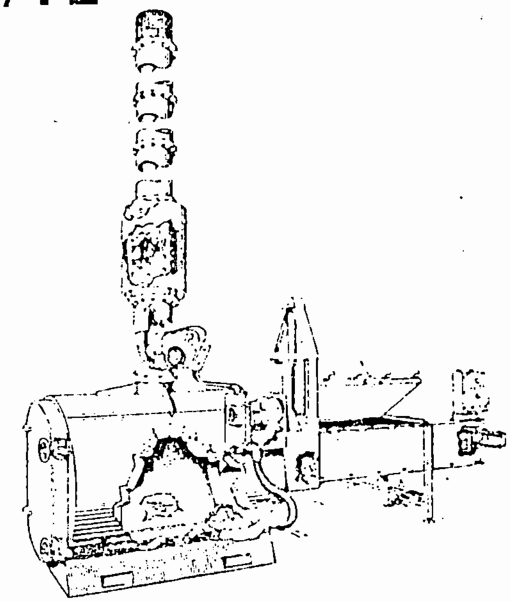
EWG/jar

Attachment "D"

KELLEY

PYROLYTIC INCINERATION SYSTEM

SPECIFICATIONS — MODEL 1280/72



PROCESS DESCRIPTION

The Kelley Pyrolytic Incineration System is a process which accepts combustible waste of varying calorific values via the feeder; converts the waste to a combustible gas under controlled air and temperature conditions in the pyrolytic chamber; achieves complete combustion through ignition of the combustible gas yielding a high temperature CO_2 and H_2O vapor flue gas in the thermal reactor; and ducts the resultant flue gas to the stack for exhaust to the atmosphere.

PYROLYTIC CHAMBER

Shell manufactured of hot rolled steel plate. Shell is lined with 9½ inches of insulation and high temperature castable refractory material suitable for operation to 2,500° F. The refractory is secured by steel anchors welded to the shell. Embedded in the refractory are two steel air distribution ducts. No grates are required.

The cleanout door (large object charging), providing complete access, is refractory lined and hinged with thrust bearings for manual operation. Two screw type sealing devices and hasp for a padlock are provided. Door to be factory hinged on either right or left as required.

THERMAL REACTOR

The outer shell is manufactured of hot rolled steel lined with 3 inches castable refractory suitable to temperatures of 3,000° F. Upper portion (inspirator) includes shroud covered combustion air inlets. Attached to the lower portion are refractory lined inspection ports and provisions for mounting of burners.

Air is introduced into the thermal reactor by natural draft through the inspirator section. This assures minimum outside fuel usage because cold air is drawn in only as demanded by the combustion process. Air is admitted sequentially along an extended portion of th reactor eliminating quenching of the fire by concen trated infusion of cold air.

Additional combustion air is introduced by a forced a system controlled by a modulating damper.

FEEDER

A heavy-duty semi-automatic charging device co sisting of a receiving hopper with hydraulic doo charging ram, refractory lined vertical charging doo refractory lined transition chamber, and hydraul power assembly with controls.

Fabricated of hot rolled steel plate with a capacity 72 cu. ft. Feeder opening is 72" long by 54½" wide b 32" deep. Door is fabricated of hot rolled steel wi formed steel structural members. Door operat hydraulically. Door to be factory hinged either right left as required.

STACK

The stack and spark arrestor are manufactured of AI type 304 stainless steel with flanged sections for bol ing together.

SYSTEM RATING

	Type 0	Type 1	Type 2	Type 3
BTU/lb. of Waste (Ave.)	8500	6500	4300	2500
Incinerator Capacity (lb./hr.)	1090	1300	1160	840

SEQUENCE OF OPERATION

1. After feeding hopper is filled, door is shut and locked.
2. Automatic feeding cycle is started by depressing start button until indicator light goes on.
3. Vertical charging door hydraulically opens.
4. Charging ram moves forward pushing load through transition chamber into main combustion chamber.
5. Charging ram retracts to position immediately outside of vertical charging door. Ram face is sprayed with water.
6. Vertical charging door closes.
7. Charging ram retracts to start position.
8. Indicator light goes off. Cycle is complete. Feeder door opens.

CONTROLS

Incinerator Control Panel: The function of this panel is to control combustion air, temperatures and all system modes. It houses temperature controllers, timers, relays and switches in a NEMA 12 enclosure.

Feeder Control Panel: The function of this panel is to control the operation of the feeder. It houses a motor starter, timer, relays and switches in a NEMA 12 enclosure.

AUXILIARY SYSTEM REQUIREMENTS

FUEL:
Natural Gas, Fuel Oil, LPG.

Normal usage 675,000 BTU's per operating hour.

Gas: Piping capable of delivering 1,000,000 BTU per hour at burners. Natural gas at 6" to 8" W.C., LPG at 11" W.C. (sized for start-up usage with pyrolysis chamber burner on.)

Oil: Oil burners equipped with nozzle capacity of one gallon per hour each. One pump is included. Line should be sized for 30 gallons per hour. (2 pipe system)

UTILITY REQUIREMENTS

Required utilities brought to incinerator by others are:

Electrical: Incinerator—115 VAC, single phase
60 HZ, 15 AMP

Feeder—460 VAC, three phase
60 HZ, 20 AMP

MOTOR SCHEDULE—FULL LOAD

	HP	VOLTS	AMPS
Primary Blower	1	460	1.8
Feeder	3	460	4.8
Pyrolysis Chamber Burner (optional)		115	3.0
Thermal Reactor Burner		115	3.0
Mics.—Controls		115	1.0
Add for the Following Options:			
Oil Burner(s) (per Burner)		115	5.8

WATER

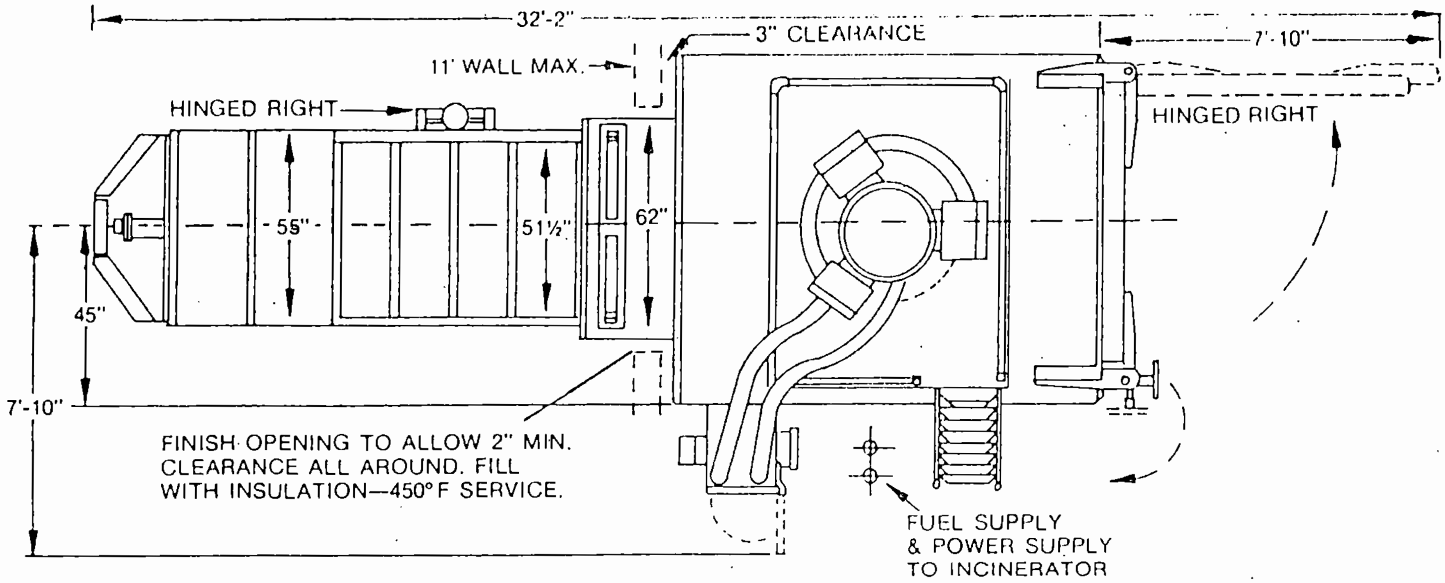
Water (filtered) shall be provided for water spray systems, cleaning and safety. Minimum requirement is ¾ inch line 50 PSIG. Sewer or other drainage provisions should be provided at both feeder side and combustion chamber side. Freeze-up protection is required.

RECOMMENDED MINIMUM SLAB SIZE:

6" CONCRETE. 6" × 6" #6 WIRE MESH REINFORCING. 12'-0" WIDE × 35'-0" LONG

CODES AND REGULATIONS

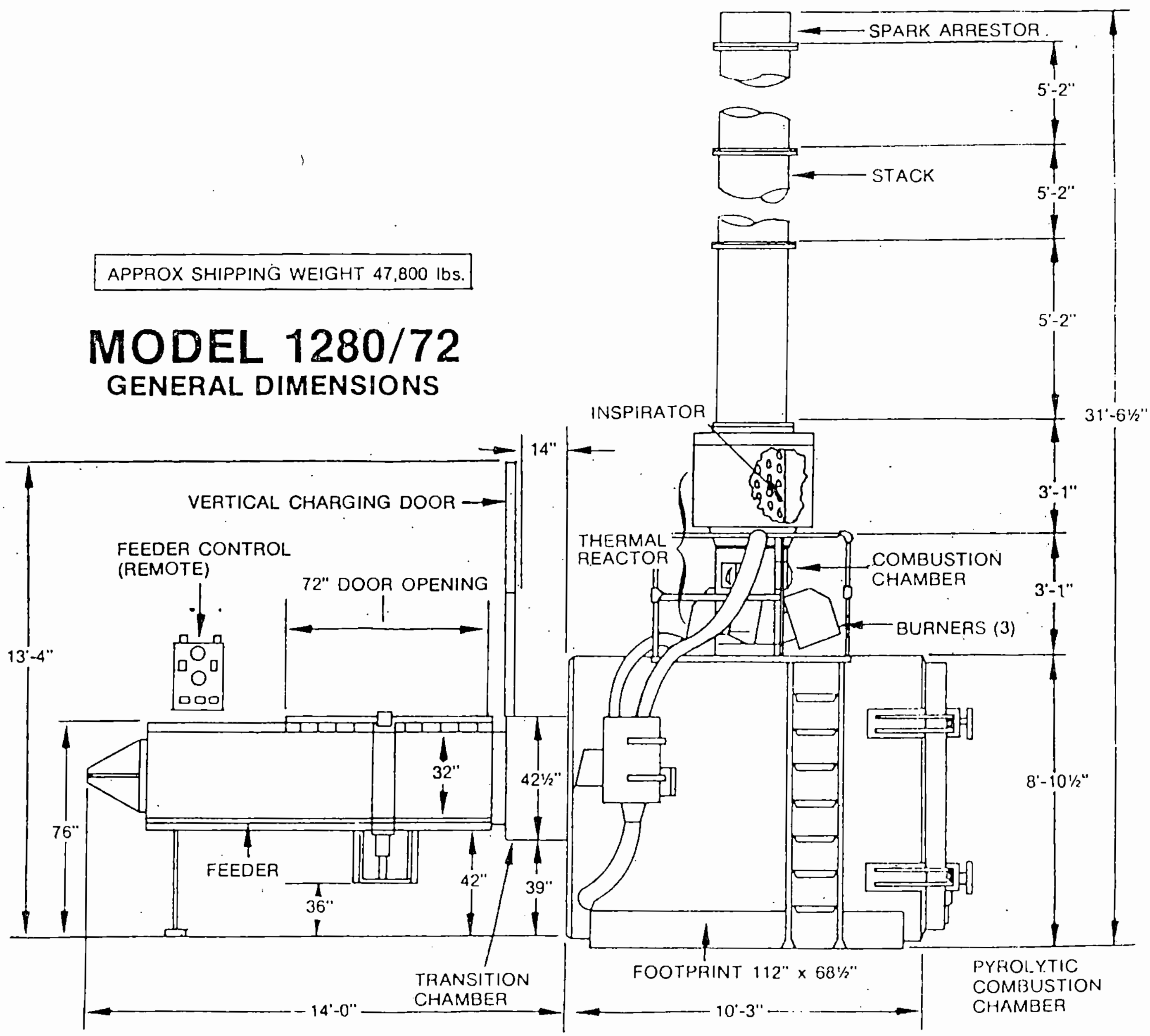
Steps should be taken to determine if equipment and installation is in compliance with all state and local codes, regulations and standards.



APPROX SHIPPING WEIGHT 47,800 lbs.

MODEL 1280/72

GENERAL DIMENSIONS



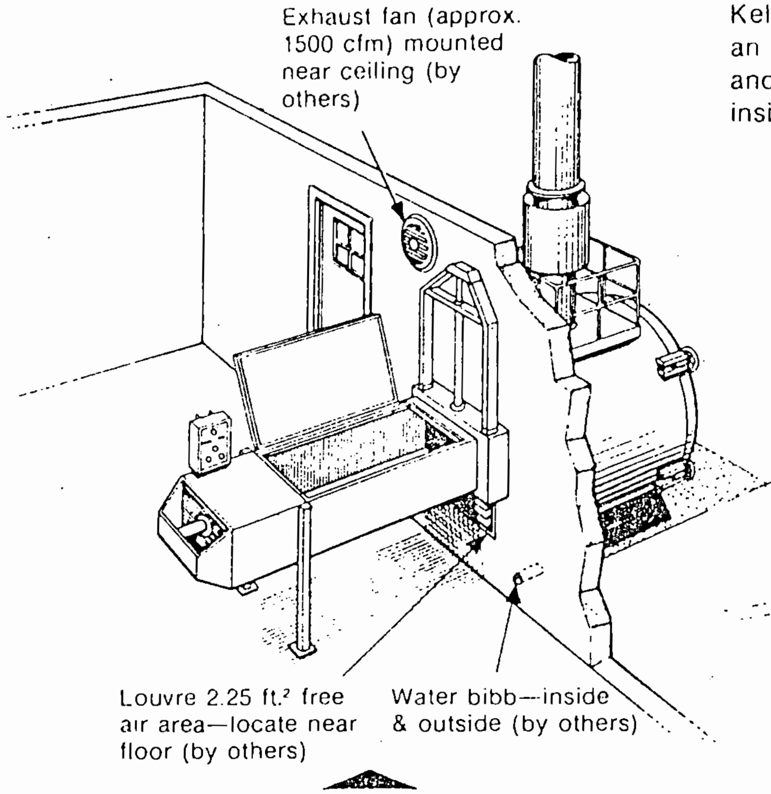
TYPICAL INSTALLATION ARRANGEMENTS

Kelley Pyrolytic Incinerators may be installed on an outside slab or with the feeder inside a building and the burner outside, or with the entire unit inside.

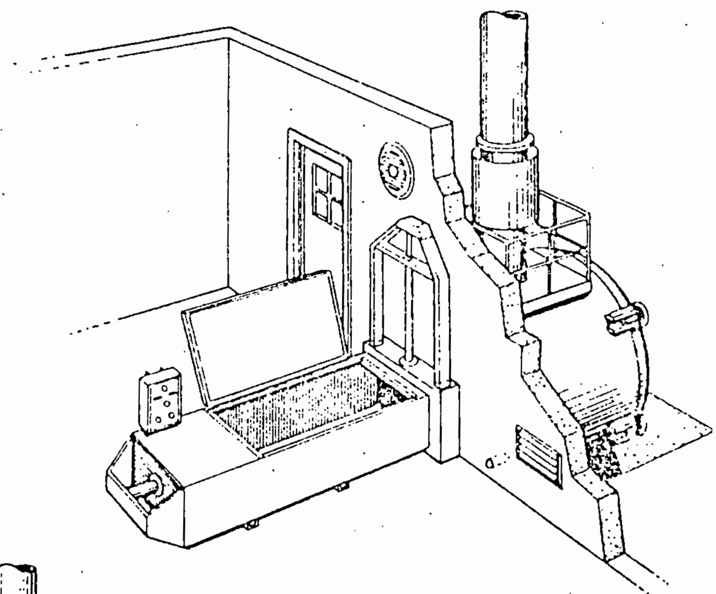
Installations totally within a building require combustion air make-up, special stack exits, thimble etc. Please consult factory for more information.

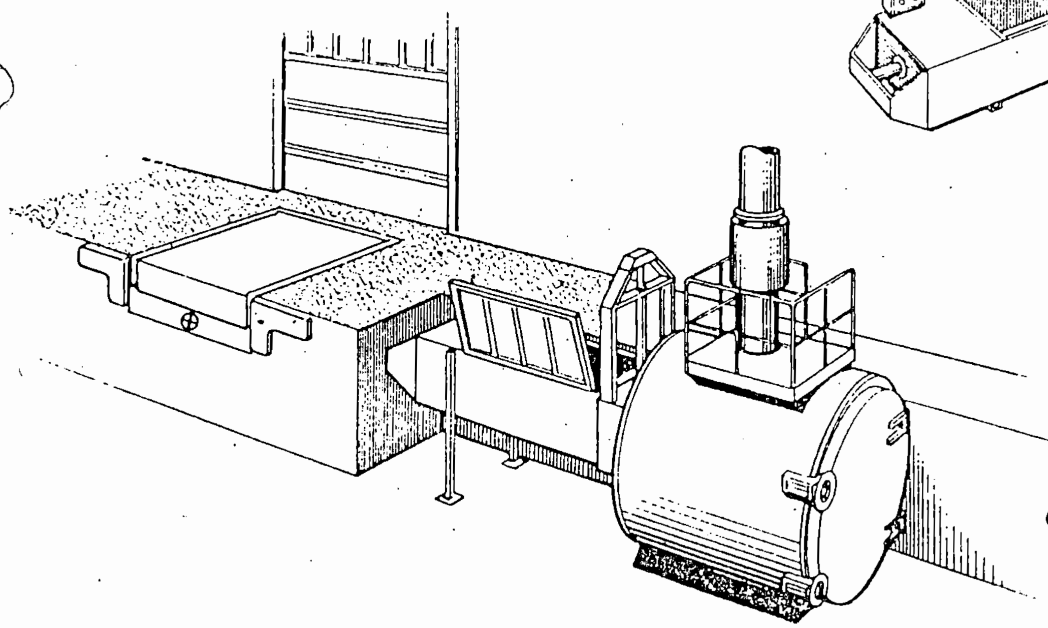
NOTE — INSIDE/OUTSIDE/ INSTALLATIONS

A maximum presssure differential of .025 W.C. relative to outdoor ambient must be maintained at the feeder location. The louvre & exhaust fan shown work together to provide ventilation. A closed waste room is strongly recommended. Check local codes.



Typical inside/outside installations (Feeder may also be recessed in pit to reduce feeder height.)

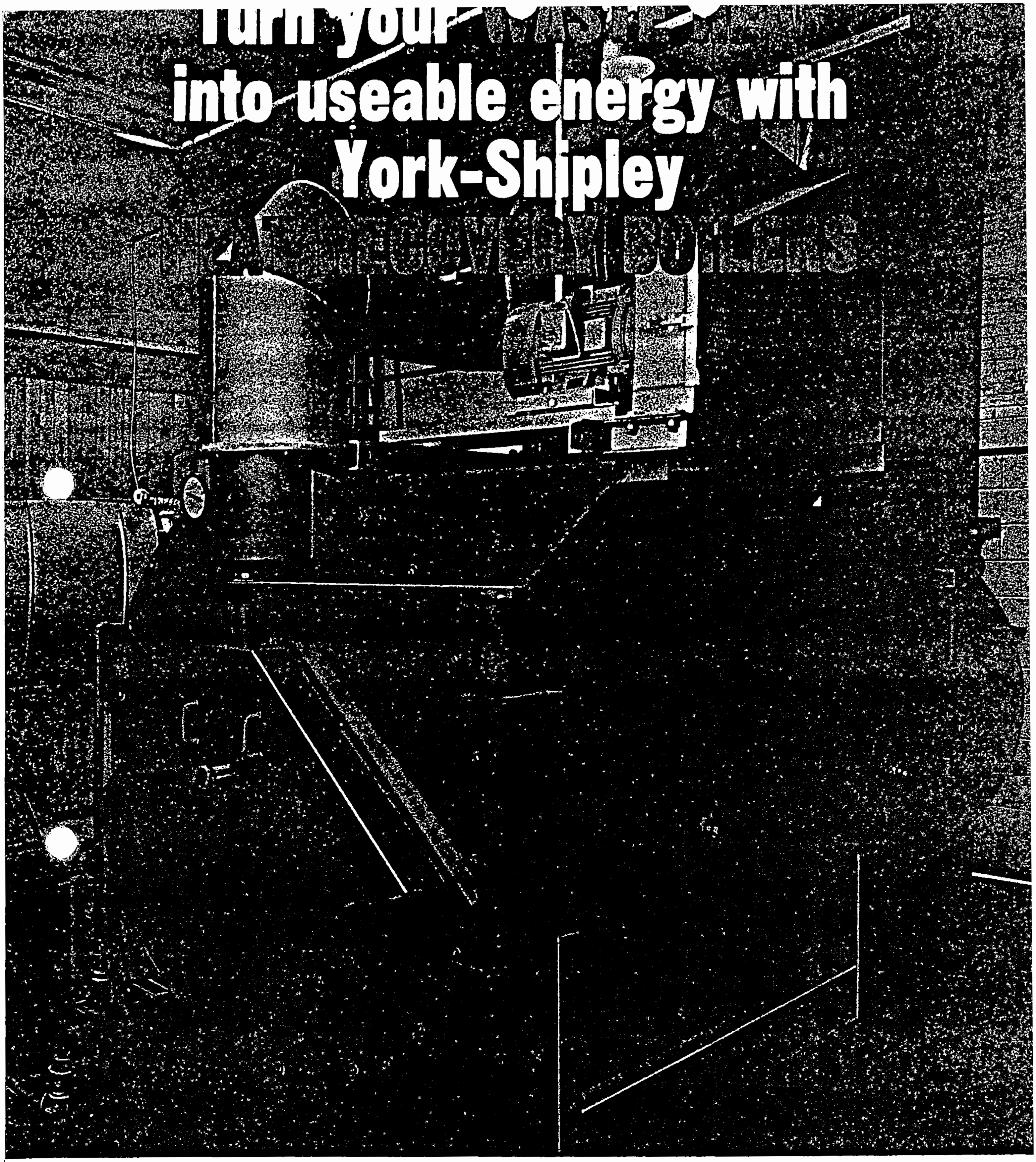




Outdoor installation beside loading dock for easier feeding.

KELLEY®

Kelley Company, Inc. • 6720 N. Teutonia Ave. • Milwaukee, WI 53209
Phone: 414-352-1000 Telex: 26-661



SIZES FROM 600 TO 21,000 POUNDS OF STEAM PER HOUR

HIGH PRESSURE - HRH MODELS **LOW PRESSURE - HRL MODELS**

YORK SHIPLEY, INC., YORK, PA.

P.O. BOX 349, YORK, PA. 17405 (717)755-1081

Using Waste As Fuel

YORK SHIPLEY
AUTOMATIC BOILERS

The utilization of steam as a heat recovery media, from the combustion of wastes, in an industrial plant is attractive since it can directly supplement existing boilers to supply: 1. process steam; 2. comfort heating in the winter; or 3. air conditioning in the summer. Furthermore, packaged boilers, directly adaptable to waste heat recovery, are readily available from York Shipley

The York-Shipley heat recovery boiler is a three pass horizontal fire tube packaged boiler, designed for pressures up to 250 PSI. It is constructed in strict accordance with all applicable ASME codes.

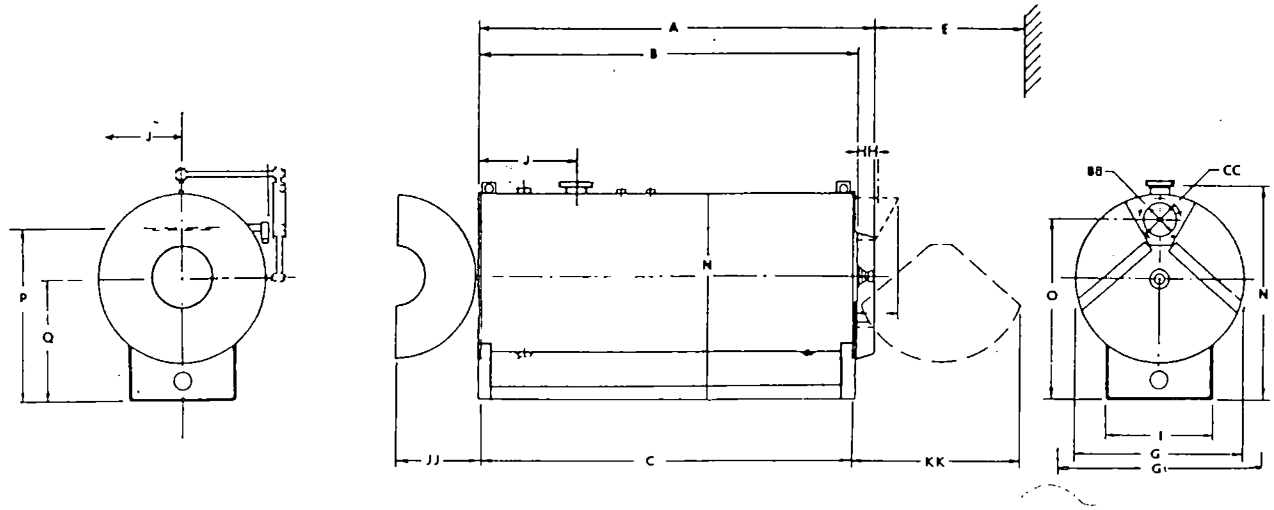
The first pass consists of one large single tube. The inlet of this tube is connected to the waste heat source. The second and third passes consist of multiple tubes. The flow area proportion of all passes assures even gas velocities through the boiler for maximum heat transfer efficiency. The rear of the boiler is sectioned for easier handling and inspection. The boiler is encased in a two inch fiber glass insulating blanket.

The flue gas outlet of the boiler can be equipped with an induced draft fan, which provides the regulated draft necessary to draw the flue gas through the boiler tubes. The fan outlet is connected to the stack.

As hot gases pass through the boiler, heat is transferred to the water side and steam is generated. Baffles below the steam outlet assure dry steam. Water is pumped to the boiler by a feed water pump which is controlled by the water level in the boiler.

HEAT RECOVERY BOILERS DIMENSIONS & DATA
MODEL HR-125 THRU 750-G

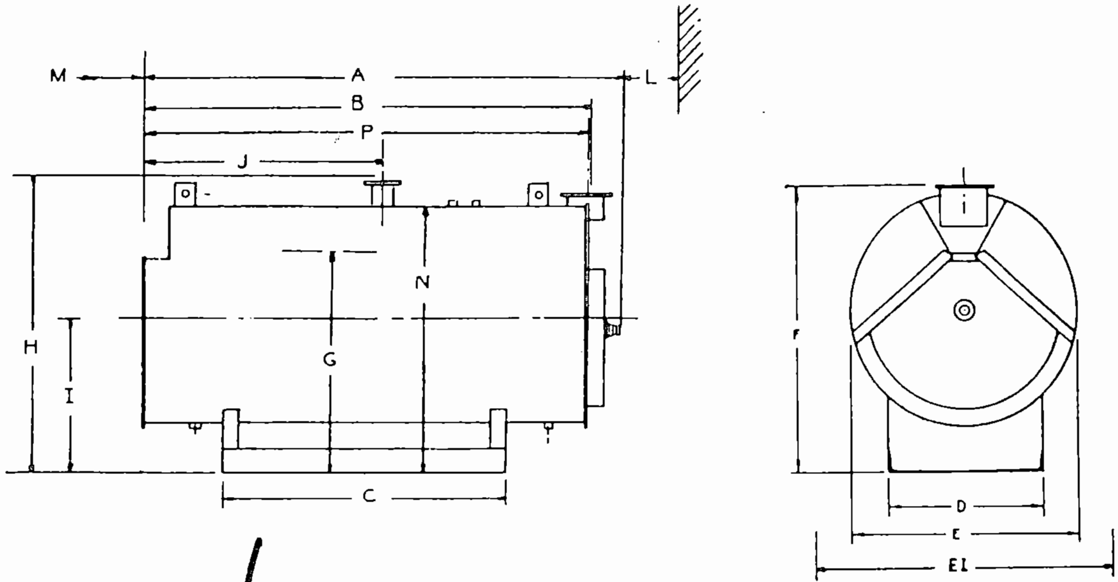
Dimensions shown are accurate enough for layout purposes. Consult factory for certified for construction drawings.



Model No.		HR-125	HR-150	HR-200	HR-250	HR-300	HR-350	HR-400	HR-500	HR-625	HR-750
Heating Surface FIRESIDE SQ.FT.		125	150	200	250	300	350	400	500	625	750
Approx. Output LBS./HR. †		620	740	985	1230	1500	1725	1975	2465	3080	3700
A—Overall Length		5'4"	6'1"	7'8"	9'3"	8'7"	9'9"	10'11"	9'0"	11'0"	13'5"
B—Length of Boiler		4'11"	5'9"	7'3"	8'10"	8'3"	9'5"	10'7"	8'9"	10'6"	12'3'
C—Length of Skid		4'9"	5'6"	7'1"	8'8"	8'1"	9'3"	10'5"	8'7"	10'4"	12'1"
E—Dist. Rear Tube Removal***		2'6"	3'2"	4'9"	6'4"	5'4"	6'6"	7'8"	5'10"	7'7"	9'2"
G—Width of Boiler		3'11"	3'11"	3'11"	3'11"	4'5"	4'5"	4'5"	5'5"	5'5"	5'5"
G1—Overall Boiler Width		4'4"	4'4"	4'4"	4'4"	4'10"	4'10"	4'10"	6'2"	6'2"	6'2"
I—Width of Skid Outside		2'6"	2'6"	2'6"	2'6"	2'9"	2'9"	2'9"	3'3"	3'3"	3'3"
J—Location Top Conn.	HRL	2'4"	2'4"	2'4"	2'4"	2'4"	4'7"	4'7"	4'3"	4'3"	4'3"
	HRH	2'3"	2'4"	2'3"	2'3"	2'3"	3'2"	3'2"	4'3"	4'3"	4'3"
N—Overall Height*		5'0"	5'0"	5'0"	5'0"	5'7"	5'7"	5'7"	6'7"	6'7"	6'7"
N1—Floor to shell Height		4'7"	4'7"	4'7"	4'7"	5'1"	5'1"	5'1"	6'1"	6'1"	6'1"
O—Height Vent Conn. ℄		4'2"	4'2"	4'2"	4'2"	4'8"	4'8"	4'8"	5'7"	5'7"	5'7"
P—Height Water Line		4'1"	4'1"	4'1"	4'1"	4'7"	4'7"	4'7"	5'2"	5'2"	5'2"
Q—Floor to ℄		2'10"	2'10"	2'10"	2'10"	3'1"	3'1"	3'1"	3'7"	3'7"	3'7"
BB—Vent Size - Dia.		9-3/4"	9-3/4"	9-3/4"	9-3/4"	11-1/2"	11-1/2"	11-1/2"	11-1/2"	11-1/2"	11-1/2"
CC—Vent Bolt Circle		11-1/2" 5-3/8" HLS.	11-1/2" 5-3/8" HLS.	11-1/2" 5-3/8" HLS.	11-1/2 5-3/8" HLS.	13" 5-3/8" HLS.	13" 5-3/8" HLS.	13" 5-3/8" HLS.	13" 5-3/8" HLS.	13" 5-3/8" HLS.	13" 5-3/8" HLS.
HH—Rear Cover to ℄ Vert. Vent**		7"	7"	7"	7"	7-1/2"	7-1/2"	7-1/2"	7-1/2"	7-1/2"	7-1/2"
II—Length of Vert. Vent		1'2"	1'2"	1'2"	1'2"	1'3"	1'3"	1'3"	1'3"	1'3"	1'3"
JJ—Dist. Swing Front Cover		1'11½"	1'11½"	1'11½"	1'11½"	2'2½"	2'2½"	2'2½"	2'8½"	2'8½"	2'8½"
KK—Dist. to Swing Rear Cover		4'3"	4'3"	4'3"	4'3"	4'10"	4'10"	4'10"	5'8"	5'8"	5'8"
Bottom Shell to Floor		12"	12"	12"	12"	12"	12"	12"	12"	12"	12"
Supply Sizes	HRL	6" Flg. 150#	6" Flg. 150#	N.A.	6" Flg. 150#	N.A.	8" Flg. 150#	8" Flg. 150#	8" Flg. 150#	8" Flg. 150#	8" Flg. 150#
	HRH	2" SCR.	2" SCR.	2" SCR.	2" SCR.	2" SCR.	2½" SCR.	2½" SCR.	3" SCR.	3" SCR.	3" SCR.
Return Size	HRL	3" SCR.	3" SCR.	3" SCR.	3" SCR.	3" SCR.	4" SCR.	4" SCR.	4" SCR.	4" SCR.	4" SCR.
Dry Weight	HRL	2155	2430	3425	3950	N.A.	5335	5860	7140	8670	9750
	HRH	2300	2655	3835	4540	5250	6125	6815	8610	10430	11790
Wet Weight	HRL	3445	4005	5570	6665	7845	8895	9950	12060	14820	17130
	HRH	3655	4305	6075	7380	8680	8985	11135	13530	16575	19160
Water Capacity Gallons		163	198	342	342	385	453	520	591	740	889

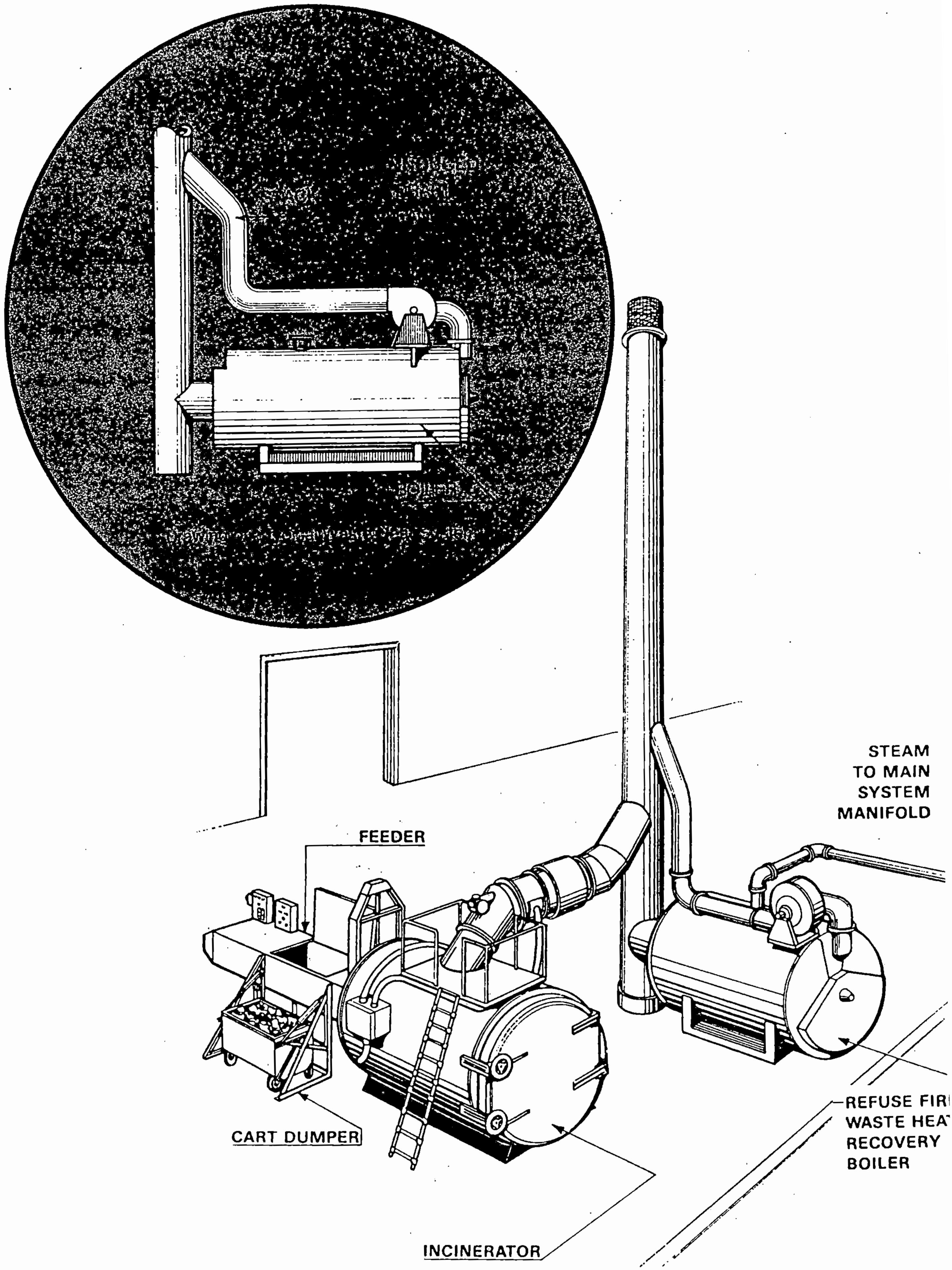
*Clearance for Safety Valves 8".
**Vertical Vent Opening Size Same as BB & CC.
***Front Tube Removal May Be Used Where Space Permits.
† Actual Output depends on temperature and quantity of waste gas.
Specifications & Dimensions shown are subject to change without notice.

HEAT RECOVERY BOILERS DIMENSIONS & DATA
MODEL HR-875 THRU 4250-G



Model No.		HR-875	HR-1000	HR-1125	HR-1250	HR-1500	HR-1750	HR-2000	HR-2500	HR-3000	HR-3500	HR-4250
Heating Surface FIRESIDE SQ.FT.		875	1000	1125	1250	1500	1750	2000	2500	3000	3500	4250
Approx. Output LBS./HR.**		4310	4930	5545	6160	7400	8625	9860	12,300	15,000	17,250	20,945
A—Overall Length		12'-10½"	14'5"	15'-10½"	15'-1"	17'-5½"	19'-10½"	20'-10"	21'-0"	24'-5"	24'-5"	25'-7"
B—Length of Shell		12'-1"	13'-7"	15'-1"	14'-1"	16'-6"	18'-11"	19"-10"	19'-10"	23'-4"	23'-3"	23'-9"
C—Length of Skid		7'-5"	8'-11"	10'-5"	8'-11"	11'-4"	13'-9"	14'-4"	14"-4"	17'-10"	17'-9"	17'-5"
D—Width of Skid		3'-11"	3'-11"	3'-11"	4'-6"	4'-6"	4'-6"	5'-0"	5'-4"	5'-4"	6'-0"	7'-0"
E—Boiler Width		5'-9"	5'-9"	5'-9"	6'-9"	6'-9"	6'-9"	7'-3"	7'-10"	7'-10"	8'-6"	9'-9"
E1—Overall Boiler Width		7'-3"	7'-3"	7'-3"	8'-3"	8'-3"	8'-3"	8'-11"	9'-6"	9'-6"	10'-4"	11'-10"
F—Height of Vent Conn.		7'-1"	7'-1"	7'-1"	8'-7"	8'-7"	8'-7"	9'-5"	9'-11"	9'-11"	9'-4"	11'-6"
G—Heigth of Water Line		5'-10"	5'-10"	5'-10"	6'-10"	6'-10"	6'-10"	7'-6"	7'-8"	7'-8"	8'-3"	9'-2"
H—Overall Height		8'-5"	8'-5"	8'-5"	9'-6"	9'-9"	9'-9"	10'-3"	10'-9"	10'-9"	11'-7"	12'-10"
I—Floor to ℄		4'-1"	4'-1"	4'-1"	4'-11"	4'-11"	4'-11"	5'-1"	5'-5"	5'-5"	5'-9"	6'-2"
J—L[illegible]ion Top Conn.		6'-8"	7'-6"	6'-8"	7'-6"	8'-8"	8'-8"	9'-2½"	9'-2½"	9'-2½"	9'-2½"	9'-6"
L—Di[illegible] Rear Tube Removal*		8'-6"	10'-0"	11'-6"	9'-6"	11'-11"	14'-4"	14'-8"	14'-8"	18'-2"	17'-11"	17'-3"
N—Floor to Shell Height		6'-9"	6'-9"	6'-9"	8'-0"	8'-0"	8'-0"	8'-7"	9'-1"	9'-11"	9'-9"	12'-11"
P—Location Vent Conn.		12'-0"	13'-6"	15'-0"	14'-0"	16'-5"	18'-10"	19'-10"	19'-10"	23'-4"	23'-3"	23'-9"
Bottom Shell to Floor		18"	16"	16"	20"	20"	20"	20"	20"	20"	20"	18"
Supply Sizes	HRL	10" Flg. 150#	10"Fig. 150#	10" Fig. 150#	10" Fig. 150#	10" Fig. 150#	10"Fig. 150#	10" Fig. 150#	12" Fig. 150#	12" Fig. 150#	12" Fig. 150#	14" Fig. 150#
	HRH	4" Fig.	4" Fig.	4" Fig.	6" Fig.	6" Fig.	6" Fig.	8" Fig.	8" Fig.	8" Fig.	8" Fig.	10" Fig.
Return Size	HRL	150# 4" Scr.	150# 4" Scr.	150# 4" Scr.	150# 4" Scr.	150# 4" Scr.	150# 4" Scr.	300# 4" Scr.	300# 4" Scr.	300# 4" Scr.	300# 4" Scr.	300# 6" 150# Fig.
Vent Size Dia.		14½"	14½"	14½"	18"	18"	18"	28"	28"	28"	28"	34"
Vent Bolt Circle		16-3/4" 6-7/16" HLS.	16-3/4" 6-7/16" HLS.	16-3/4" 6-7/16" HLS.	20-3/4" 8-7/16" HLS.	20-3/4" 8-7/16" HLS.	20-3/4" 8-7/16" HLS.	36-1/2" 12-9/16" HLS.	36-1/2" 12-9/16" HLS.	36-1/2" 12-9/16" HLS.	36-1/2" 12-9/16" HLS.	38" 12-9/16" HLS.
Dry Weight	HRL	12,290	13,430	15,570	20,610	21,250	23,630	34,000	39,000	42,500	45,200	62,000
	HRH	14,740	16,160	18,590	18,870	23,210	25,820	35,250	40,500	45,650	50,700	70,500
Wet Weight	HRL	19,450	21,650	24,870	30,020	34,700	39,410	52,800	61,650	69,800	76,000	100,700
	HRH	21,900	24,380	27,890	31,760	36,660	41,600	54,050	63,150	72,950	80,500	109,200
Water Capacity Gallons		863	991	1120	1345	1620	1900	2270	2730	3290	3710	4670

Specifications and dimensions subject to change without notice.
*Front Tube Removal May Be Used Where Space Permits.
**Actual output depends on temperature and quantity of waste gas.



Drawing of a typical Incinerator System

STANDARD EQUIPMENT

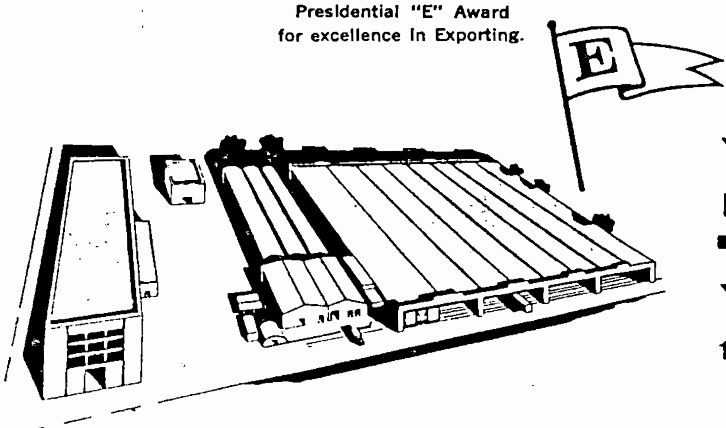
1. Jacket & Insulation
2. Water Level Control
3. Refractory
   a. Front End of Furnace Tube
   b. Rear Chamber
   c. Rear Cover
4. Trim Items
   Safety Valves, Steam Pressure Gauge, Water Gauge Set, Try Cocks
5. Safety & Operating Limits
6. Water Level Controls and Steam Controls wired to Terminals in Junction box on boiler saddles or skid.

IMPORTANT ORDERING INFORMATION

When ordering, the following must be specified, in addition to the model numbers:

1. Amount of Waste Gas
   LBS/Hr. or CFM
2. Temperature of Waste Gas
3. Boiler Operating Pressure
4. Pounds of Steam required
5. Source of Waste Gas
6. Pressure of Waste Gas

Presidential "E" Award
for excellence In Exporting.



YORK SHIPLEY, INC.
P.O. BOX 349, YORK, PA. 17405

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KELLEY LIQUID WASTE FEEDER

SYSTEM DESIGN

The Kelley Liquid Waste Feeder is designed for use with the Kelley Pyrolytic Incinerator. It is automatically controlled and allows disposal of liquids at the same time as solid waste is disposed of. The system can handle liquid wastes commonly generated by industrial plants and hospitals.

The system consists of three assemblies; tank and flow control unit, injector and control box.

Installation requires that the control box be wired to a junction box on the tank and flow control unit and to the injector, and that pipe connection be made between the tank and flow control unit and the liquid injector.

The liquid feed rate is fully modulated and controlled by the incinerator exhaust temperature. It modulates at two temperature set points, upper and lower set point.

At the upper set point, the feed rate decreases on temperature rise. This action occurs when burning liquids with high BTU values, which drive up the exhaust temperature and thus the exhaust temperature is limited to a pre-set limit. The lower set point comes into action when feeding liquids with low BTU values, such as water based liquids, which drive down the exhaust temperature.

At the lower set point, the feed rate decreases on temperature drop. The purpose of the low end modulation is to assure that minimum conbustion temperatures are maintained in order to achieve complete burnout in the incinerator thermal reactor.

When the exhaust temperature stays between the upper and lower set point, full liquid feed rate is maintained.

Liquids are injected into the upper portion of the pyrolysis chamber. The liquid is atomized by compressed air in an atomizing nozzle. Compressed air is used for atomization in order to maintain atomization throughout the whole range of flows. The liquids evaporate above the solid waste firebed and then flow to the thermal reactor, where they are ignited and complete burnout is achieved.

If the liquid contains heavy particles, these will fall by gravity into the pyrolysis chamber firebed due to the low velocities and turbulence level in the pyrolysis chamber.

TANK AND FLOW CONTROL UNIT

The tank and flow control unit is prewired and pre-piped. It contains the pump, motorized flow control valve, manual valves, pressure and vacuum switches, liquid screen and a 120 gallon holding tank. These components are all enclosed in a steel cabinet with doors for easy service access.

The cabinet is equipped with a guage panel for monitoring of liquid pressure and vacuum and also an atomizing air pressure guage and regulator. An on/off switch permits start-up and shutdown of the system.

All wiring and electrical components in the tank and flow control unit are housed in explosion proof enclosures.

The tank is equipped with level switches for control of feed pump and also for a transfer pump if liquids are automatically supplied to the 120 gallon tank.

The pump suction line is connected at a point approximately 1/2" from the bottom of the tank in order to prevent the heavy solids from entering the system.

A drain valve is located at the bottom of the tank and this allows draining of the tank should large amounts of heavy solid accumulate at the bottom. There is a 12" by 12" opening on the top of the tank allowing manual dumping of liquids.

The system uses a fixed displacement feed pump, which assures that the feed rate is maintained even if pressures vary due to liquid viscosity, or by partial nozzle plugging.

Two styles of pumps are used, progressing cavity pump and gear pump. The progressing cavity pump uses a screw type rotor in an elastomer stator. Since the stator is flexible, this pump can handle liquids with solid particles. The stator is compatible with oil base liquids, alcohol, water base liquids and some solvents. It's not compatible with ether, lacquers or lacquer solvents, or ketones. * Amine

The gear pump is employed for liquids not compatible with the materials of the progressing cavity pump. The gear pump uses Teflon seals, which are chemically compatible with almost all liquids. However, the gear pump cannot handle liquids containing solid particles. PARTIC SIZE

The gear pump is equipped with an internal relief valve, which limits the pipe pressure to 100 psi.

The pump draws the liquid from the tank through a 1-1/2" pipe. The flow velocity in the suction side is low, maximum ten feet per minute. The suction line is equipped with a strainer to protect the pump. It is also equipped with a vacuum switch, which will shut down the pump in case of excessive vacuum. Limit ?

The pressure side of the pump is connected to the injector, which feeds the liquid into the incinerator, and also connected via a return line back to tank. A motorized metering valve in the return line controls the flow back to tank and thus the flow to the injector. The pressure side is equipped with a pressure unit switch in order to shut down the pump in case of line plugging.

The piping is supplied with manual valves to allow service to be performed without draining the entire system. The piping is also supplied with numerous pipe unions, again for easier servicing.

INJECTOR

The liquid injector assembly is extended into the pyrolysis chamber and retracted by a pneumatic cylinder. It is automatically retracted when the pumps are shut off in order to protect the nozzle from heat when no liquid is flowing. A cam actuated cap covers the injection port when the nozzle is retracted.

The nozzle uses compressed air to atomize the liquid. The liquid orifice is large, 5/16", in order to keep the nozzle tip from fouling or plugging when used with liquids containing solid particles. The design of the nozzle is such that the liquid flows straight through the center and thus reducing the opportunity for solids to accumulate.

The atomizing air and liquid is mixed outside the nozzle and the liquid breakup is accomplished by four air jets directed towards the liquid stream as it leaves the nozzle. The liquid leaves the nozzle at low pressure, 5-15 psi.

CONTROLS

The system is controlled from a central control panel, which is independent from the incinerator and feeder control panel. The only connection the liquid injection system control has with the incinerator control is the charge door limit switch. The other necessary interface controls are provided by temperature sensors located in the pyrolysis chamber and the incinerator exhaust.

The control panel is equipped with an on/off switch for manual shutoff and pilot lights indicating high vacuum or high pressure conditions.

There are three temperature controllers in the control panel. Two of these are proportional, i.e. modulating, controllers and one is an on/off controller. All the temperature controllers are designed such that if they fail, they will fail in a safe mode.

The modulating controllers sense the exhaust temperature and control the motorized valve in the liquid return line. One controls the upper modulation set point, and the other the lower modulation set point. The upper modulation set point controller has an auxiliary set point, which switches the temperature control function over to the lower set point controller at a temperature approximately half way between the upper and lower modulation set points.

The control action of the modulating controllers is such that when a decreased liquid feed rate is called for by the exhaust temperature, the motorized valve opens and thus more liquid is returned to the tank, leaving less for the nozzle.

A limit switch operated by a cam on a slip clutch arrangement is mounted on the flow control modulating motor. This limit switch senses the rotational direction of the modulating motor and is connected to an adjustable repeat timer. This timer makes it possible to control the time required to close the modulating valve and can be adjusted such that it takes up to one full hour to increase the liquid feed rate from 0% to 100%. This timer eliminates the risk of the exhaust temperature overshooting its set limit due to time lags in the combustion system.

When the modulating valve opens, i.e. decreases the feed rate, the limit switch bypasses the timer and the feed rate will decrease from 100% to 0% in 50 seconds. This is done so that the system can react quickly if there is a combustion surge from solid waste being charged.

The pump is interlocked with the main chamber temperature by the on/off controller. The purpose of this is to assure that there is a certain minimum pyrolysis chamber temperature for a safe light-off.

A time delay relay allows the valve to return to its open position at start-up so that lightoff will take place at a low liquid feed rate, again to assure safe lightoff.

The pump is interlocked with the vertical charge door of the solid waste feeder on the incinerator so that no liquid will flow during the feed cycles. This is to prevent potential liquid flashbacks.

A time delay is incorporated for the pneumatic cylinder air valve so that when the pumps shut down, the nozzle will stay extended for a short period of time in order to let the injector drain into the pyrolysis chamber rather than on the outside of the pyrolysis chamber.

The injector is equipped with a limit switch, which keeps the pump and atomizing air from activating until the injector is extended, again to prevent liquids from draining on the pyrolysis chamber.

The tank assembly includes three ultrasonic type liquid level controllers, one low level controller and two high level controllers. In case of low liquid level in the tank, the system will automatically shut down and the nozzle will be retracted. The same action will automatically be taken, if the vacuum on the pump suction or pressure on pump discharge side exceeds its limits, which are factory preset.

The high level controllers will operate a transfer pump supplying liquids to the tank/flow control unit. One normally controls the pump and the other one is a safety back-up controller to assure that the tank will not overflow in case of failure of the normal controller.

SEQUENCE OF OPERATION

The operation of the Liquid Feed System is automatic.

In order to start the Liquid Feed System, the pyrolysis chamber of the incinerator has to be preheated. This is generally done by loading of the solid waste, but can also be done by preheat with the burner.

When the pyrolysis chamber reaches 800°F., the system is activated. A time delay permits the control valve to move to its fully open position to prepare the system for low-fire start. When the exhaust temperature from the solid waste reaches 1300°F, the valve on the pump return line starts to close. An end switch on the modulating motor closes, the injection nozzle is extended and the pump starts.

Liquid is now being injected into the pyrolysis chamber. If it is a high BTU liquid, the exhaust temperature will rise, the valve will close further until maximum feed rate is achieved. The time for complete closure is adjustable up to one hour. If the temperature reaches 1600°F, the valve again starts opening and the feed rate is cut back. Thus, the valve controls the temperature so that it will stay at the set point.

If solid waste is charged at this point, the exhaust temperature will rise further, and the modulating valve will cut back on the liquid feed rate.

The temperature controlled valve thus assures that the exhaust temperature doesn't exceed the incinerator design temperatures, which in turn are related to the heat release. As the heat release from the solid waste tapers off, the exhaust temperature drops and the liquid feed rate is increased. In essence, even exhaust temperatures are maintained as long as high BTU liquids are available.

When burning low BTU liquids, the liquid will cause the exhaust temperature to drop. When the temperature drops below 1500°F, the liquid flow rate will start to cut back to prevent further temperature decrease. This means that when burning low BTU liquids, solid waste in sufficient quantities must be available to maintain minimum combustion temperature or the liquid feeder will shut down.

Should at any time during liquid feed the pyrolysis chamber drop below 800^{o}F, the pump will shut down and the nozzles will retract.

During the operation, whenever the exhaust temperature is outside the operating range, i.e. not between upper and lower set point, the pump will shut down and the system be deactivated.

POWER/AIR REQUIREMENTS

The system operates on 110 volt single phase power. The maximum operating current is 10 amps.

Nozzle and pneumatic cylinder requires compressed air. Maximum consumption is 25 SCFM and maximum required pressure 40 psig.

APPLICATIONS

The Liquid Feed System is designed to handle most liquid wastes generated by industry. This includes cutting oils, lube oils, alcohols and solvents.

The liquid must be pumpable. For any liquids with a viscosity above 5,000 SSU, equivalent to No. 6 fuel oil or 30 weight lubricating oil, consult factory.

When liquids are part of the waste stream, the incinerator is sized in the same manner as when sizing for solid waste only, i.e. by BTU Value and lbs./hour.

BTU values for liquids are generally given in BTU's per gallon and amounts of liquids generated per day generally in gallons per day. To convert from BTU per gallon to BTU per lb., simply divide by the density of the liquid. When converting from gallons per day to lbs. per day, multiply by the density. The density generally will fall between 7 and 9 lbs. per gallon.

In addition to liquid disposal during the regular solid waste feeding hours, it's possible to dispose of liquids during the burndown. The thermal capacity of the incinerator and the BTU value of the liquids then determines the amount of liquids that can be disposed of during burndown.

When disposing of high BTU liquids, the burning rate will equal the feed rate, as opposed to when burning solids in which case the feed rate is higher than the actual burning rate. Accordingly, the following guidelines should be used for sizing liquid waste comsumption during periods when only liquids are disposed of.

Thermal Capacity:	2500, 14,000,000 BTU/hour
	1280, 7,500,000 BTU/hour
	780, 4,750,000 BTU/hour
	380, 2,500,000 BTU/hour

In the initial phase of the burndown, some solids will be burned, generally during the first two hours. During this period the liquid feed rate will increase as the heat release from the solid waste decreases. For sizing purposes, the average liquid feed rate during this initial phase equals half of the thermal capacity of the incinerator model.

Example. Model 1280 disposing of liquids during burndown. How long will it take to dispose of 200 gallons of 125,000 BTU per gallon liquid.

Maximum liquid feed rate: 7,500,000 ÷ 125,000 = 60 gallons per hour.

Feed rate during initial burndown phase equals 30 gallons/hour.

Liquid disposed of during the first two burndown hours: 30 x 2 = 60 gallons.

Liquid left after initial burndown phase: 200 - 60 = 140 gallons.

Time to burn: 140 gallons = 140 ÷ 60 = 2.33 hours.

Total liquid burn time after beginning of burndown: 2 + 2.33 = 4.33 hours.

UNIQUE FEATURES

Several features on the liquid feeder are unique. The main feature is the modulated feed rate. It enables the user to use spare heat release capacity of the incinerator when the incinerator is charged at less than rated capacity such as during lunch hour and burndown. It also stabilizes the heat output of the incinerator, and if equipped with a boiler, the steam output.

The system is operated automatically, i.e. it automatically comes on and off without operator interference. This automatic control is also valuable in that liquid can be disposed of during periods when no full time operator is available.

~~The retractable nozzle is unique.~~ The retracting feature extends the life of the nozzle and also reduces the possibility of plugging when burning liquids that can set up by heat.

The system is packaged in a standard configuration. The skid mounting simplifies the installation.

Fixed displacement pump with return valve modulating is also unique. It allows system pressure to vary when liquid viscocity varies without changing flow rate characteristics.

Injection assembly does not include a burner. Liquid is simply evaporated in the pyrolysis chamber and heavier particles contained in the liquid will drop down into the firebed. The nozzle has a large orifice and is of simple construction.

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KIE/mf